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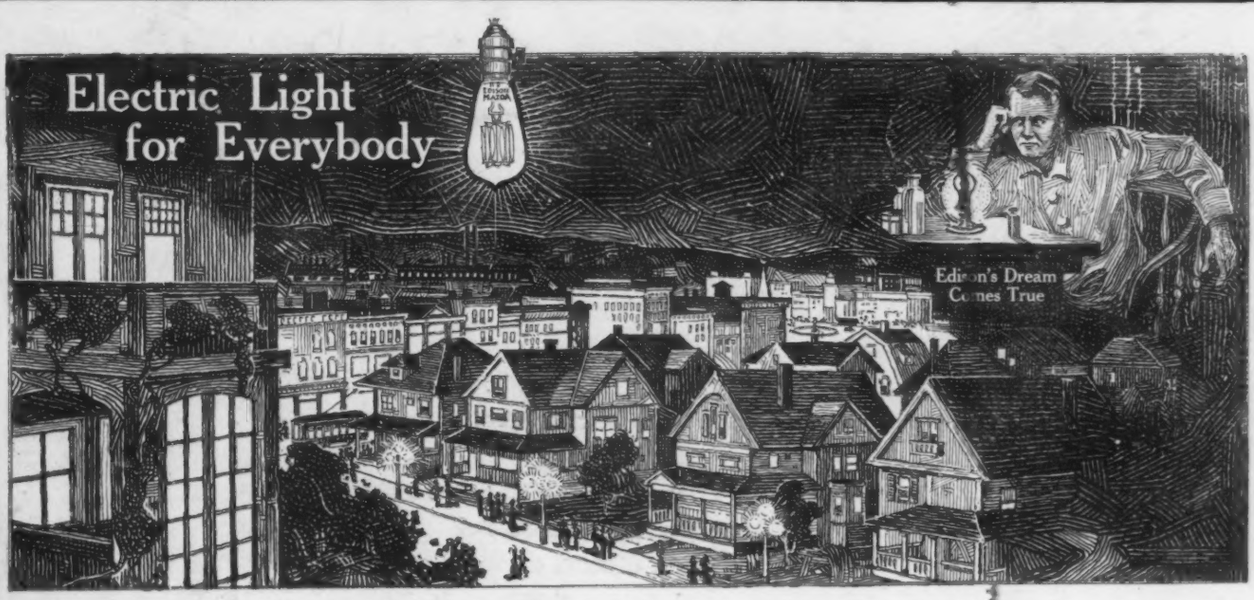

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The World's Greatest Double Deck Lift Bridge Across the Willamette

THE LARGEST DOUBLE-DECK LIFT BRIDGE

BY PAUL C. BUTTE[1]

The Willamette River bridge, containing a great many novel constructive features, is the largest double-deck lift bridge in the world, and the only one having a lower movable deck. This bridge was built by the Oregon-Washington Railway & Navigation Company, a corporation controlled by the Southern Pacific Company, across the Willamette River at Portland, Oregon. The company owned a bridge about 200 feet south of the new bridge. This old bridge was built about 20 years ago. At that time they did not contemplate the rapid growth of Portland, and figured the bridge to carry a trolley car and a couple of wagons in addition to the old-style steam cars of light construction. During the past three or four years the bridge was very much overloaded on account of the jamb of trolley cars and vehicles. Portland is confronted with the same problems that prevail in San Francisco on account of the city being surrounded by hills and water. One of the factors that entered into the overloading of the bridge was the carrying of automobiles—it was possible to bring about an excessive weight on account of the smaller space taken up with the auto compared with the space of the horse and wagon. I am told that during the rush period in the evening, the bridge deflection on a span of about 250 ft. was nearly 4 in. The railroad company decided finally not to run its heavy locomotives across this bridge, and a light switching engine was coupled up on the east side when it was necessary to carry the cars across.

In the early part of 1910 the construction of a new bridge was taken up, and the firm of Waddell & Harrington, of Kansas City, was appointed to design and take charge of the work. Permits were obtained by the United States Government to erect a lift bridge (on condition that the old bridge be wrecked to clear the channel) with the east approach—beginning at the foot of Oregon street, and the west approach beginning at the foot of Third street. Another condition imposed was that at no time during the construction of the bridge was there to be any obstruction whatsoever in the channel to stop navigation. This condition caused the engineers to use their ingenuity in a very interesting way, as I shall describe later.

The total length of the bridge from approach to approach is 2500 ft. The concrete piers supporting the spans were sunk into bedrock, and a very formidable construction was obtained. Size of piers at towers is: Base, 50x90 ft., and height 120 ft. When the first soundings were made it was believed the bedrock could be obtained easily, but later on this proved to be only a shell of rock with clay beneath, and the real foundation was obtained by going down a depth of 60 ft. It required over a year's work to construct the piers and foundations for the approaches.

There are two decks to this bridge, the lower for a double track for train service and the upper for the two sidewalks and wagon roads and double tracks for

[1] [The foregoing paper was read by the author before the San Francisco Jovians, November 26, 1912.]

street cars. The tracks of the lower deck are laid over 6 by 8-in. wooden ties, which are placed directly on the top of steel girders. The upper deck is paved with wooden blocks laid on 4-in. planks.

The draw span is of the lift type. The Government requires a possible clearance for all vessels of 250 ft. horizontally, and 140 ft. vertically. This clearance is obtained by lifting up a 250-ft. section of the bridge to a height to give 140 ft. clearance from the high-water line. Of course, all vessels do not require this clearance, and for this reason the double-deck lift bridge with a movable lower deck is of inestimable value in preventing interference of traffic on the upper deck, for the lower deck may be raised enough to clear the top of all vessels not over 70 ft. clearance. If the vessel requires a greater clearance, the lower and upper decks are raised. It was found that only 30% of the vessels passing require over 70 ft. clearance. When the bridge was first operated many of the smaller vessels refused to pass under after the lower deck was raised, as they were used to a full open channel, and they were not able to judge the clearance. This was overcome by painting a 2-ft. strip of white along the side of the towers, as shown, with the foot markings in broad, black, horizontal stripes. Now all a captain has to do is to watch his clearance figures. The bridge operator determines the distance by means of a mechanical indicator, consisting of a hand and dial geared down and connected to the drum shaft.

Williamette River Bridge Showing Open Lift.

Steel Work.

There is over 9000 tons of steel in this bridge. The approach span weight is 6500 tons. The total weight of the lift span with its machinery is 2500 tons. The height of towers is 243 ft. to top of sheaves, and 363 ft. high from base of foundation, or about the same height as a 30-story office building. The steel work was furnished by the American Birdge Company and erected by Robert Wakefield of Portland, and there was not a single misfit in the entire structure. Besides, the erection was carried on without a mishap, and only the loss of one life, that of a painter who lost his balance on the east tower, falling 150 ft. This accident took place toward the end of construction, when most of the hazardous work was completed.

The Lift Span.

As will be seen from the pictures, the lift span is counterbalanced by immense blocks of concrete fastened to sixty-four 2¼-inch on steel cables, having a total breaking strain of 16,000 tons. These cables run over 20 ft. steel sheaves placed on the top of the towers on each side. There are similar smaller counter weights connected with each of the panel points of the lower span. These are suspended by sixty-four 1½-in. cables. It is obvious that the lower deck is suspended in hangers fastened to the lower chord of upper deck, so that the cables do not carry any weight outside of the weight of the span itself. When the lower deck is down the hangers are locked in position automatically, so that there will be no tendency for the lower deck to spring up under a moving load, such as a train of cars would be. There are also locks for holding the ends of the lower and upper decks in place. There are twelve lower deck hanger locks, four upper deck locks, and four lower deck end locks. All of these locks must work in a sequence, and to do this the arrangement of the electrical details forms a very important part.

The motors, controllers and electrical equipment was installed by the Butte Engineering & Electric Company, and a great deal of the apparatus was built in its local shop.

The electrical equipment consists of a 15 h.p. motor for operating the hanger locks, two 200 h.p. motors for the upper deck, two 200 h.p. for the lower deck, and two 15 h.p. for operating the lower deck end locks. All of these motors are provided with magnetic brakes, the larger brakes being fastened directly to the steel work. The voltage is close to 600 d.c., and all motors are of the series type, entirely enclosed. The 200 h.p. motors have a normal starting torque of 4500 pounds.

Considerable thought was given toward providing means in case of breakdown of electric service or of parts of the machinery.

First—In case of breakdown of motors, an interconnecting switchboard is provided, consisting of eight 4-pole double throw switches and four 2-pole double-throw switches for solenoid brakes. The control is arranged so that any one, any two, or all four motors may be connected in series parallel, or so that any one, or any two motors may be cut out of service at will. Suitable clutches are provided to connect the motors mechanically to either the lower or upper decks.

Second — In case of breakdown of service, a double-throw switch is provided in the operator's

house, connecting with either of the two services on the east and west sides of the bridge.

Third—In case of total breakdown to both services, a winch is provided with suitable levers to operate the bridge by man power. Of course, this would be a very slow process, and would require considerable time to perform a complete opening.

The motors are controlled by a unit switch system of multiple control, so arranged and interlocked that—First, the current cannot be turned on to the motors which operate the upper deck until the locks have been opened and the deck is free to rise. Second, the current cannot be turned on to the same span until the lower span is raised to its highest point, properly locked there by the solenoid brakes on its motors.

Limit Switches.

The limit switches are arranged to cut off the current when the upper deck and lower deck have reached the limit of travel. These switches operate on the screw principle, geared to the drum shaft. In case the operator allows the bridge to go beyond the limit, he cannot operate the bridge without pressing a special short-circuiting button placed near the controller handle. There are also limit switches on the lower and upper deck lock motors, but after these were placed in operation it was found that a signal system, indicating when the limit was approached, was preferable.

The Operating Room of the Great Bridge

Signal Lights.

There is a complete signal system on the bridge, enabling the operator to find out exactly where he stands, and is a precaution against accident. There are signal lamps for indicating the extreme positions of the hanger locks and the end locks of the lift or upper deck. These are located in the operator's house, and connected with the power circuit—two lights for each lock—arranged so that red light will glow when the lock is fully driven, green light when fully opened.

As this bridge is the first of its type, special instructions were required for semaphore signals from the government. At the center of the lower deck on both up and down stream sides there are four cast-iron semaphores, each having four 8-in. Fresnel lenses—colored green and red. Each semaphore has a separate switch, and a master lamp of corresponding color in series with it in the operator's house. The following combination is worked:

Two red semaphore lights indicates both decks down.

One red upper, 1 green lower light , upper deck down and lower deck up, respectively.

Two green upper lights indicate both decks up.

A special trolley construction was used to make connection to the lower deck.

There are also four pier semaphores of standard type.

There is a complete system of electrolier lighting on the bridge, as well as bells and telephones to signal between the operator's house and the upper and lower decks. A five-ton traveling crane is installed in the machinery house.

The bridge engineers are deserving of a great deal of praise for clever designing. Before the structure was accepted by the owner, it made over a thousand successful trips without requiring any adjustments.

AN INVESTIGATION OF EXPLOSION-PROOF MOTORS.

The results of a series of investigations of explosion-proof electric motors for mines is published in Bureau of Mines Bulletin 46 by H. H. Clark. The general conclusion is that a thoroughly satisfactory motor has not yet been submitted.

The term "explosion-proof" refers to a motor inclosed by a casing so constructed that an explosion of a mixture of mine gas (methane) and air within the casing will not ignite a mixture of the same gas surrounding the motor. There are two classes of motors so constructed: First, a totally inclosed class built strong enough to withstand high internal pressures and so designed that the efficiency of all inclosing covers can be satisfactorily maintained; second, a class provided with relief openings or valves designed to relieve the pressure of an explosion within the motor casing and to cool any products of combustion discharged through the valves.

A satisfactory motor of the first class is much more expensive to build than an equally safe motor of the second class. For this reason, attempts to make motors explosion-proof have been confined chiefly to motors of the second class.

The function of explosion-proof devices for electric motors is to reduce below the ignition point of gas (methane) the temperature of any flames that may be discharged from the motor casing.

Of five protective devices submitted, one was rejected without test, one failed completely in test, and each of the others failed under one or more conditions of test. One of the three devices last mentioned dis-

The Bureau of Mines is prepared to make tests of explosion-proof motors for the purpose of establishing a "permissible list" of such machines. Schedule 2 of the bureau described the conditions under which such tests will be undertaken and states the fees charged for the work. This schedule may be obtained by applying to the Director of the Bureau of Mines, Washington, D. C.

RATE FIXING AND APPRAISAL

AUTOMATICALLY DIRECTED METHOD OF RATE FIXING AND PRICE CONTROL.

BY F. K. BLUE.

The automatically directed method of rate fixing which was suggested in last week's issue is here presented in greater detail. The principles involved in this method would be practically carried out in the following manner:

The physical valuation of the properties of the given corporation would be established to correspond to the actual legitimate investment upon which the stockholders were entitled to receive dividends.

To establish service rates or prices for say next year, the previously estimated operating expenses for next year would be estimated from actual expenses of this and previous years, according to definite methods stated in the franchise and conforming to the nature of the utility.

The previously estimated sales for next year would be estimated from this and previous years according to similar principles.

The estimated sales for this year would be computed by averaging the actual sales for this and previous years according to methods defined in the franchise.

The estimated gross earnings for this year would be computed by applying this year's previously estimated rate of profit to this year's estimated sales.

The estimated operating expenses for this year would be computed by applying the properly adjusted actual unit cost of production for this and previous years to the estimated sales for this year.

The difference between the estimated gross earnings and the estimated operating expenses would be the estimated net earnings for this year.

The ratio of these estimated net earnings for this year to the average market valuation of all outstanding stock based on prices asked during the year would form the rate of profit to be used in fixing the service rates and prices for the next year.

This rate of profit applied to the physical valuation of the properties would give the previously estimated net earnings for next year.

These previously estimated net earnings for next year added to the previously estimated operating expenses for next year would give the previously estimated gross earnings for next year.

Then the previously estimated gross earnings for next year divided by the previously estimated sales for next year would establish the service rates and prices for next year.

To illustrate the working of this method, suppose that the rate fixed for service be such that the rate of profit for this year is 10 per cent on physical valuation. Suppose further that the conditions with regard to probable future income from the property is such that the average investor feels that he can just afford to invest his money in the enterprise for an expected return of 7 per cent on his investment. The conditions resulting from the methods of rate fixing to be followed are such that, although the return on investment during this year is known to amount to 10 per cent on physical valuation, yet it is also known that the return in the future will be gradually reduced to about 7 per cent on physical valuation. Therefore the stock valuation for this year will not be about 120 on a par value of 100, corresponding to a perpetual annuity of 10 per cent on the physical valuation, but it will be at some figure considerably less, probably at a value of about 110. This average stock valuation during the year, then, will represent the price which the average investor could just afford to give or take for the stock. The present year's profit of 10 per cent, divided by the present year's average valuation of 110, gives a rate of profit for next year of about 9 per cent. At this rate of return on physical valuation, the stock valuation at 7 per cent for next year would be about 107. The 9 per cent profit for next year, divided by the average stock valuation of 107 for next year, gives in turn a rate of profit to be applied to physical valuation of about 8½ per cent for the year following. It is evident that by continuing this process, the rate of profit will finally approach 7 per cent, which is the investor's estimate of the value of the risk involved in the enterprise, and the average valuation of the stock will finally approach the physical valuation of the properties.

In the same manner, if the rate of profit were at any time below the rate required by the investors' valuation of the risk involved in the undertaking, this rate of profit and the stock valuation would be gradually increased until it approached the investors' estimate and the physical valuation.

From this it appears that if the owners of the stock tried to increase its valuation beyond that which an average investor would be willing to pay for it, they would soon suffer loss of income on account of the decrease in the rate of profit determined by this year's valuation, which would result in a smaller rate of service to be fixed in the next year. On the other hand, if the stock owners should reduce its valuation this year, thinking thereby to be able to establish a higher rate of profit and thereby enjoy a greater income from the higher service rate that would follow in the next year, they would risk the loss of their expectedly greater return through the purchase of their stock in the market by investors who might be willing to accept a smaller rate of profit on their investment.

Fraudulent price fixing would be at once indicated by an abnormal fluctuation in the value of the stock as soon as discovered by an investor not in the conspiracy.

To provide for deferred dividends, the rate of profit at which they are to be amortized should be fixed by competitive bidding for the original fran-

chise, the service rate during the period of amortization being estimated by adding a return based on the rate of profit bid to a reasonable future cost of production at normal plant capacity.

To conform to the principle that the immediate relation of profit to cost of production should not be destroyed, the original physical valuation should be based on an estimate of cost made previous to construction of the plant and adjusted by unforseen expenses and savings occurring during construction but for which the management was not responsible.

Many minor adjustments would be necessary, and it would undoubtedly take much thought and attention to detail to put such a method in practice in a perfected form, but it is fortunate that the elements of difficulty involve points of relatively minor importance. There could be considerable discrepancy and rough approximation in regard to these points without detracting seriously from the value of the method as a whole in substantially accomplishing the valuable and important results intended in an eminently satisfactory manner.

Practical Advantages of This Method of Control.

By this method the advantages of competition would be secured more exactly than is possible under existing normal competitive conditions. Under true competitive conditions the supply of capital is determined by the relative utility of present goods and future goods to the investor who furnishes such capital. This condition is exemplified in the market control of the price of bonds, where the economic forces tend to produce a stable equilibrium. But in the case of stocks, even under conditions of normal free competition, no such tendency toward equilibrium prevails, because the expected return on investment, instead of being known and definitely fixed, depends primarily on the price of the product. Now if this price depended exactly on what any investor in the market was willing to risk his money in the enterprise for, then a true equilibrium would be approached. But this is not the case. Price even under the most normal competitive conditions is regulated by competition within much narrower limits. At best it depends on what those in the same business only are willing to risk their money for, and the slightest tendency towards community of agreement, even if unconscious, may raise the price to just below the point which those in business estimate would be too attractive for a would-be competitor, while a disagreement may unduly lower the price temporarily during "destructive competition" and lead to business failure and finally a literal combination of interests which may raise the competitive price higher than that established by agreement. There are many degrees of monopoly, which after all is only relative, but in all cases price, if lower than what will secure maximum profit on investment, depends upon the shareholder's estimate of possible competition, not on his willingness to risk his money in comparison with the willingness of any other investor in the market as in the case of bonds.

Therefore, if this method be applied to price control it will provide a truer competitive condition than that prevailing under the most favorably existing conditions of normal competition, without sacrificing any of the conditions which encourage business enterprise, and without the danger of "destructive competition." Practically it would place such stocks on the market on a basis similar to that of bonds, and in two ways on a better basis. In the case of bonds, the future return is invariably fixed in number but not in value at the investor's estimate at the time of purchase, so that changes in the rate of interest and in the value of gold—the unit measure of price—affect either the creditor or the debtor adversely in a manner that cannot be avoided unless all investors become prophets. In the other case, however, the future return on stocks would depend not only on the investor's estimate at the time of purchase, which would determine next year's income, but also on his next year's estimate which would determine the income of the succeeding year, and so on. And further, if the physical valuation were adjusted each year to correspond with changes in the value of gold as indicated by proper index numbers (until a method of adjusting the numerical value of money to the relative value of gold is adopted), then the value of future income from stock would have a further element of economic stability not possessed by bonds.

By the adoption of this method of price control, therefore, stocks would have two advantages in economic stability over bonds, since the value of returns would follow gradual changes in both the rate of interest and the value of gold. Monopoly would be a desirable institution to all parties concerned, and therefore a condition to be encouraged, while all the economic advantages of competition would be realized at the same time in a more perfect manner than has ever been possible in the past. The advantages of both monopoly and competition would benefit both the producer and the consumer, while the investor would have more assurance of getting all that he thought his risk was worth (just as if he bought a well secured bond), since gambling in and manipulation of such stock would be confined to very narrow limits, and the returns resulting from unusual business enterprise would be enjoyed more nearly by those who created them. Since all fictitious stock valuation would be eliminated, it would be much safer for banks to lend money to such enterprises, and likewise it would inspire the confidence of the depositors in such banks. Serious business crises would then be averted, since it would be publicly known what was represented by the securities on which such loans were based.

OREGON DITCHES RUINED BY BEAVERS.

Beavers, which are protected by law in Oregon, are becoming such an unbearable pest in destroying some of the irrigation ditches in the state that a law will be introduced at the next session of the legislature to allow them to be killed. Tygh Valley, one of the first districts in Oregon to be put under the charm of modern irrigation, is so infested with the animals, that irrigation ditches have been diverted from their course in a night, others made absolutely useless, young and tender trees sawed off or peeled and eventually killed and other crops ruthlessly ravaged.

RATE FIXING AND APPRAISAL

STATE CONTROL VERSUS MUNICIPAL.

BY WILLIAM J. HAGENAH.

Much discussion is still the order of the day relative to the effectiveness of state control as opposed to each municipality directing its own utility undertakings. The subject came up for discussion at the recent conference of northwest municipalities at Walla Walla, Wash. William J. Hagenah, former chief statistician of Wisconsin, contributed some notable remarks apropo to the subject from which the following abstract is taken:

The necessity for state control is emphasized by the relationship between the making of rates and taxation. For either purpose the property of a corporation must be valued. In those states which have followed a progressive policy with respect to these problems we see state tax commissions or boards of assessment working side by side with the public service commissions, each profiting by the data collected and the expert assistants of the other. This condition is destined to remove the tendency of the cities to claim a high value for purposes of taxation but a low value when the making of rates is in issue. The co-operation of public departments cannot be realized for any great length of time where the taxing and rate-making powers are exercised by two distinct and widely separated political units, each responsible to a different authority. State commissions are continuing bodies with a line of precedents to consider, not unlike those of a court, while the policy determining branch of our city governments generally changes every two or four years.

The physical conditions of our public utilities make local regulation impractical. Many utilities, especially electric companies, have been wisely brought under one management in the interest of economy. Especially is this true in the western states where power is transmitted over long distances from a central hydraulic generating station. It is not difficult to find instances of as many as thirty or even fifty communities being served by a single company from one transmission system, which often extends into two or more states and through a large number of cities and villages. Obviously, every city receiving service from such a system must be charged with its proper proportion of the value of the system, but it is difficult to understand how a score or more cities, acting independently as they must, could properly assign these values to the satisfaction of each. One can imagine conditions of municipal regulation of such a corporation where in time cities might claim a large interest in the transmission system for purposes of taxation, but deny such interest when the question of rates was in issue. The same condition could arise with respect to water companies which are frequently compelled to go long distances to mountain streams or lakes for an adequate supply of wholesome water, or could disturb the street railway system of any large city which is nearly always interurban in character. Not many years ago cities sought to regulate railroad terminals. Today the error of such a course is generally understood and the facts which brought about state regulation of interstate carriers apply with equal force to state regulation of all public service corporations.

It would be impossible for municipalities to maintain an organization skilled in public utility matters. Aside from a very few large cities, there are none which possess conditions requiring a permanent organization. While a particular service might require an extended investigation at any time, for which purpose a large and expensive staff would be required, this organization would not be necessary after the disposition of the case. It would be extremely difficult to build up such a staff in a short time and unless constantly employed it could not be maintained. Unless regulation is predicated upon thorough investigation, there is grave danger of the issues in the case becoming more or less involved with considerations other than those warranted solely by the facts. A city commission could not obtain comparative information from other companies and compel the opening of their books and records, nor could it prescribe a proper uniform system of accounts and cost analysis. Under such a method not only would the utilities of every city be compelled to deal with a separate regulating authority following different lines of thought and precedent which would destroy uniformity of methods for regulating properties, but the requirements of different cities would prevent the comparison of operating repairs among the companies themselves. Rates schedules would be computed by different methods and with chief regard to different basic conditions and standards of service such as gas pressure, candle power and heating qualities, electric voltage, water pressure, etc., would undoubtedly vary in different cities of the same state. In one instance we might find depreciation charged in operating expenses while in another city no provision for depreciation would be required. Political expediency or popular demand could frequently obtain, even above the wishes of city officials, a change in the rates exacted, or might require a standard of service which the use of the property and the revenue collected would make impossible without serious loss to the company.

The question of maintaining a commission of the character which the large utility investment in any state requires would be prohibitive for a single city. Our municipalities are today facing problems arising out of city growth and government, such as education, police and fire protection, sanitation, street improvements, etc., which are a severe burden on the public. In fact, city tax budgets are growing at such a rapid rate that conservative financiers have advised caution. For these reasons cities should look with pleasure upon the release from a function of government which is not local in character. It is not unusual to observe a city expending out of the public treasury in prosecuting a utility investigation a sum as large as that

expended by some states for maintaining a fully equipped public service commission in the discharge of the regulative duties for all the cities of the state.

Utility history further shows that companies operating under short-term franchises find great difficulty in securing extensions except through granting reductions in rates or other concessions which greatly hamper the sale of securities for needed improvements. Frequently to avoid being the object of political attack, being forced into expensive litigation or threatened with wasteful competition, corporations accept such reductions, or assume duties which increase their operating expenses, as a means of escaping from an unpleasant immediate situation, hoping to secure amends through some fortunate circumstances in the future. Any course which compels a public utility to curtail expenditures of operation, to neglect proper maintenance and improvements and to postpone provision for depreciation, will eventually be reflected through inferior service to the public. Most of these burdensome conditions are forced on the companies because of the belief that their securities are "watered." Just how this phrase originated is not known, but it has served to create a popular impression which has been a powerful force against the development of public service corporations. Many arguments concerning such corporations are met with the ever ready answer, "watered stock," although analyses of facts show that the question of capital issues is not in the least involved. This same unreasoning attitude of the public has been a barrier to the proper consideration of many utility problems between city and utility officials and has prevented much needed betterment of service.

Another of the misunderstandings of the public which has done much to bring about state regulation has been the abuse of the power of municipalities to grant franchises to competing utilities. In every state where public service commissions have taken up in earnest the great work of corporation control there has been announced the doctrine that a public utility is a natural monopoly and that the interests of the people are best served by regulating and protecting such monopoly in the discharge of its duties as long as it conforms to the obligations of the law. Opposed to this, the policy of our cities has been to encourage competition and in this manner they have helped to create the very conditions which are now criticised and from which they seek to escape. It is difficult to comprehend what a city expects to accomplish by permitting another utility to enter its boundaries when there is already one which serves the public adequately at reasonable rates. If the existing utility is giving inadequate service or is charging excessive rates the remedy lies in the power to compel that company to improve its service or to reduce its rates instead of inviting another similar corporation to tear up the city pavements for its pipe lines or rails, or to deface the streets with additional lines of poles. If an existing company is rendering adequate service at reasonable rates there is nothing to be gained by duplicating the plant and expecting two utilities, each completely equipped, to exist on the traffic and service which heretofore has supported but one company.

State regulation is further desirable because through it is possible the regulation of municipally owned utilities as well as those privately owned. There is no reason why a distinction should be drawn in the regulation of utilties because of the character of the ownership. It is immaterial to the consuming public as to who furnishes the service or who owns the plant so long as the service is adequate and efficient and the rates charged are reasonable. There should not be included in the cost of service any item incurred through a matter of sentiment concerning either the corporate or municipal form of ownership. The paramount consideration is as to which can render the best service at the most reasonable rates. The taxpayer and subscriber to utility service is entitled to receive from the municipal plant the same publicity of accounts and operating conditions, the same regard for actual costs, and the same compliance with the service requirements which are exacted of privately owned utilities. A municipally owned utility should not be operated as a source of revenue for the general fund of the city, nor should the city or any class of customers receive service at a rate which is discriminatory with respect to other classes. State regulation of municipally owned utilties is not an infringement on municipal rights; it merely provides that when a city chooses to engage in a quasi-public undertaking it shall discharge that duty with the same degree of efficiency and for as reasonable rates as would be required if the obligation were discharged by individuals or corporations.

That municipal regulation has not been attended with success is due to the fact that the regulation of the modern utility company is not a municipal function. In our theory of government there are certain functions which are distinctly local in nature. Some are state functions, while others are national in scope. Whatever character the utility may have assumed in past decades it has lost through the growth of modern conditions in which it has taken a prominent part. The regulation of such corporations in their present state-wide operations, and even interstate relation, is no more a municipal function than is the question of public education, the administration of justice, regulation of banks, or the care of the criminal and unfortunate classes. As industry and governments grow, new functions for the body politic constantly arise, while the older functions assume new aspects and those once local in character become functions of the state, just as many former functions of the several states are now being exercised by the Federal government.

Prominent among such changes has been the growing demand for state-wide regulation of all public service corporations. The conditions which affect one form of service also affect the other, and so closely inter-related are those forms of business that they cannot be successfully regulated by a score or more municipalities each operating independently. The arguments for regulation today are founded on broad principles of public policy. Modern economic thought and legislation seek to give stability to invested capital in legitimate enterprises, the substitution of a perpetual franchise or indeterminate permit for the short-term franchise, with the evils attendant upon it, the

publicity of accounts of monopolies, definite standards of service, and the physical valuation of properties charged with a public duty. It is opposed to political interference with the public service, is opposed to the waste of resources, and aims to accomplish these desirable ends through a permanent state administrative agency. Such regulation of all public service corporations through a single commission properly authorized by law and provided with facilities for the investigation and determination of all questions affecting such corporations has proved to be a success in Massachusetts, New York and Wisconsin and in a large number of states which have recently adopted this policy and modeled their legislation on that of the last two states.

SCIENTIFIC PLANT MANAGEMENT

FUNDAMENTALS OF FUEL-TESTING— WATER DETERMINATION.

BY J. P. ZIPF.

The amount of water in the oil is determined by distillation. The still is a copper vessel about 4 in. in diameter, and 6 in. high (Fig. 2), placed in an asbestos hood, the stem projecting to the condenser (upper left hand corner, Fig. 1). The condensate is discharged into a graduated tube.

The sample can is immersed in a water bath, and the cover having been released, is raised to a temperature of 150° to 170° F. The cover is fastened tightly and the can agitated for several minutes, in order that the water, which may have settled to the bottom, may be thoroughly mixed with the oil. For thorough agitation the sample can should not have been filled more than two-thirds with oil. One hundred c.c. of oil, measured in a graduated jar, is poured into the still. The exact measurement of the oil is difficult without experience, as a froth collects on the surface of the oil, obscuring any definite meniscus. The jar is washed with 50 c.c. benzol and 50 c.c. toluene, the washings being poured into the still. It should be mentioned that toluene absorbs a little water, and results might be interfered with if the toluene is not previously saturated, hence on opening a fresh bottle 5 or 10 c.c. of water should be added. The presence of water at the bottom of the bottle shows that the toluene is saturated, but care must be taken not to pour this water into the still with the toluene.

The still, after being shaken gently in order that the contents may be mixed without splashing into the stem, is placed in the asbestos hood and connected with the condenser. The hood and cover is provided to surround the still with a blanket of hot air at a uniform temperature. The still is heated gradually to a temperature of about 300° F., this temperature being reached after heating about fifteen minutes, and maintained for another fifteen-minute period. A thermometer for temperature control can be seen at the right side of the asbestos hood (Fig. 2).

The benzol passes over at a temperature of about 176.7° F., thereby wetting the condenser tube so that the water which follows will not cling readily to the latter. The toluene passes over at about 230.5° F., carrying down any water which does not happen to remain in the condenser tube. All of the toluene does not pass over, usually 15 c.c. to 20 c.c. remaining in the still with the oil. In order to make up the deficiency in toluene in the graduated collecting tube, about 15 c.c. are poured down the condenser tube to free any small drops of water which may persist in remaining.

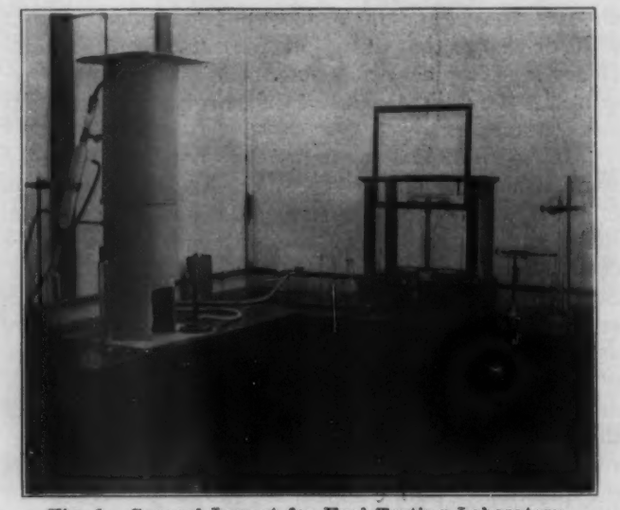


Fig. 1. General Layout for Fuel Testing Laboratory.

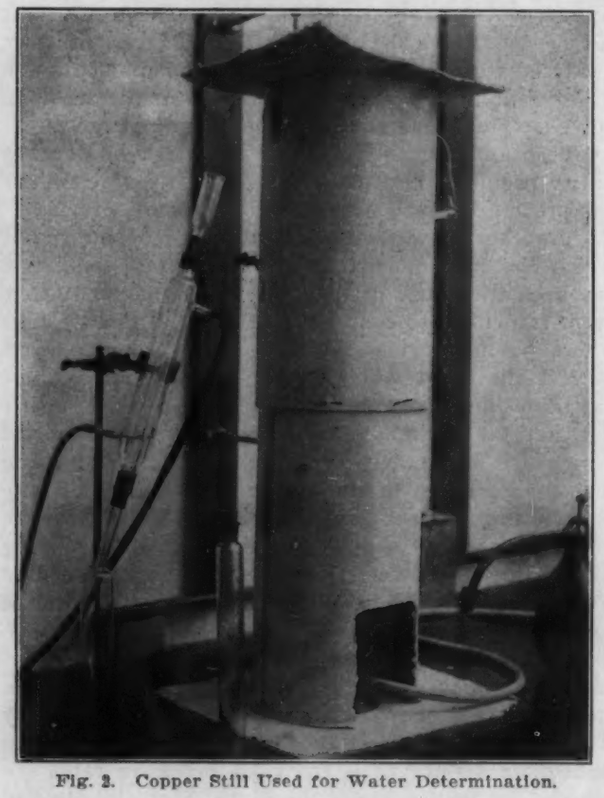


Fig. 2. Copper Still Used for Water Determination.

The still, while at a high temperature, is drained. As its contents were entirely free from water, it may be used without additional cleaning.

The distillate is at first cloudy, but later becomes clear, a sediment settling on the surface of the water which collects at the bottom. Numerous small drops of water cling to the side of the graduated tube, and must be released by knocking them off with a short wire. If the resultant water is read as cubic centimeters, the percentage of water (by volume) in the oil is easily obtained.

The water is separated from the mixture of benzol and toluol in a filter bottle, and the latter mixture can be used repeatedly.

The percentage of water by volume is, for all practical purposes, equal to the percentage by weight, the error being negligible except with a "light" oil or with considerable water present.

Distillation data on the oil we are considering is as follows:

Oil (poured from top of can)	100	c.c.
Benzol and toluene	100	c.c.
Resultant distillate:		
Water	4.7	c.c.
Benzol and toluene	82	c.c.
Condenser tube washed with toluene	16	c.c.

Thus the percentage of water by volume is 4.7%.

It may be said that this oil had been standing for six months; an earlier determination gave 7.8% water. The difference in these two values is due to the water settling. Had a sample been taken from the bottom of the can, it would have shown more than 7.8% water.

The specific gravity of the dry oil is found from the simple relation between weight, volume and specific gravity, as follows:

Let W be the per cent of water by volume,
S the specific gravity, subscripts w, o and m, referring to water, dry oil and mixture respectively.

S_w at 60° F. = .9990.

The per cent of oil by volume is 100 — W

$$S_m = S_o\left(\frac{100-W}{100}\right) + S_w\left(\frac{W}{100}\right)$$

The only unknown is S_o, and by transposing

$$S_o = \frac{S_m - S_w\left(\frac{W}{100}\right)100}{100-W}$$

$$\text{Thus } S_o = \frac{.9610 - .047 \times .9990}{.953} = \frac{.9141}{.9530} = .9591$$

So at 60° = .9591.

The per cent of water by weight is not equal to the per cent of water by volume, but for all practical purposes may be taken equal to it. Error is nominal except with very light oils or any oil with considerable moisture present.

.047 c.c. of water @ 60° F. weighs	.0469 gms.
0.953 c.c. of dry oil @ 60° F. weighs (.9591 × .953)	.9141 gms.
1.000 c.c. of mixture weighs as before	.9610 gms.

The per cent of water by weight is therefor

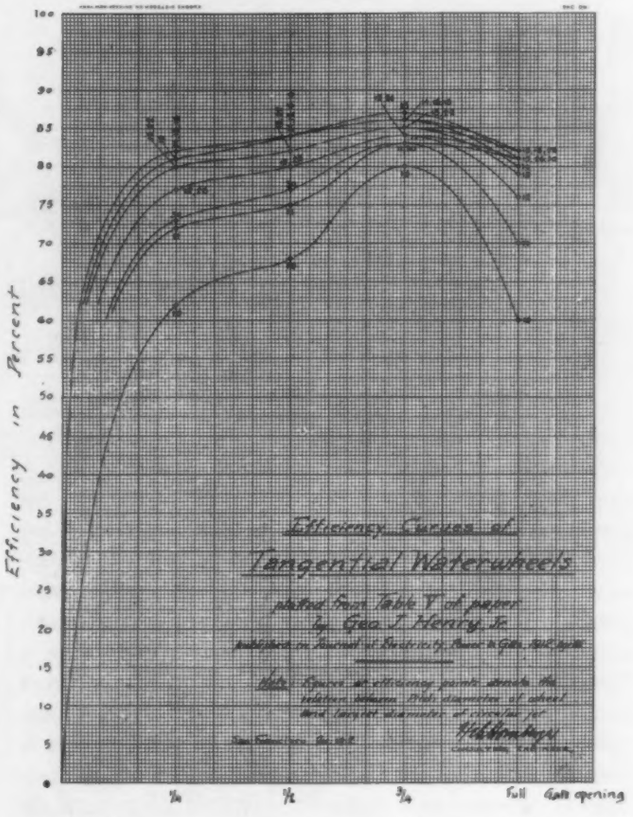
$$\frac{.0469}{.0910} = 4.89\% \text{ water, and the oil } \frac{.9141}{.9610} = 95.11\%$$

Thus by volume there is 95.3% oil, and by weight 95.11%

COMMUNICATION ON "ELEMENTS OF HYDRAULIC ENGINEERING."

To the Editor: In some of your recent issues Geo. J. Henry Jr. has published a series of papers, entitled "Elements of Hydraulic Engineering." The engineering profession is indebted to Mr. Henry for having opened his treasure chest of many years' experience and for having brought out information which heretofore had been carefully guarded by manufacturers of hydraulic power machinery as a deep secret; possibly under the assumption that it might become detrimental to their interests if the knowledge of such data was spread at large.

Having had some experience in similar lines I have read Mr. Henry's paper with a great deal of interest and found that in some details my records of facts do not seem to quite tally with his; fearing that



I might have misunderstood or misinterpreted some of the subject matter, I should like to be corrected by Mr. Henry, if wrong in my interpretation of his remarks.

On page 1 Mr. Henry gives two tables, IV and V, referring to the efficiencies of waterwheels of the tangential type, and states:

A careful review of all reliable data I have been able to collect indicates that the best efficiencies for tangential wheels are

obtained with pitch diameter from ten to thirty times the jet diameter. Efficiencies that should be obtained and the corresponding specific speeds are given in the accompanying table V and the efficiencies are further plotted in Fig. 25.

Enclosed herewith please find a diagram on which I have plotted a series of efficiency curves for wheels of different specific speeds, taking the efficiencies given on table V as points for each curve. Characteristic in all these curves is a depression between quarter load and three-quarter load, which becomes more pronounced with increasing specific speed. I am unable to account for this theoretically, and of all the test data of tangential wheels I have on hand none shows this peculiarity. An explanation of this phenomenon would doubtlessly be appreciated by everybody interested in this branch of engineering.

HEINRICH HOMBERGER,
San Francisco, Nov. 27. Consulting Engineer.

READINESS TO SERVE METHODS

CARD SYSTEM FOR RECORDS.

BY ROSS B. MATEER.

Card records of the consumer, his address, type and number of lamps used, motor and horsepower installed, are now a part of every central stations commercial organization. Data as to diversity factor, average revenue per consumer connected may be obtained only when such information is desired by any association promoting the welfare of the central station, or when the executive officers are actuated by a spirited demand on the part of the directors for information that conveys a comprehensive idea of the present condition of the property and its possibilities. That such information, available only on demand, is generally lacking is to be regretted, but that the quasi-public utility usually values its business from its own point of view without reference to the consumer is deplorable and an evidence of the lack of co-operation that should characterize the relations existing between consumer and utility. Perhaps the central station is imbued with the principle that the object of all business is revenue and seeks to maintain only such records as tend to show a maximum of revenue at a minimum of expense, and, in developing business prefers to handle existing customers with the sole object of increasing their bill and yet have such increase satisfactory to the patron served, at least to such an extent that no complaint is registered. Such a policy may work out when urban business of a commercial and residential character is considered but cannot be applied to the securing of agricultural business and to the maintaining of records which will prove of value to the utility and those served with its product.

The card records now existing in some central stations are no more complete than the one reproduced and which has served its purpose for all classes of revenue producing business perhaps through a desire to avoid the extra expense of printers' ink and the salary occasioned by solicitors whose duty it was to secure data necessary for accurate reports. Some companies have by the segregation of records into various classes procured available data for their own use, but generally have avoided any reference to the patron served and his returns from the investment in juice and its use.

Form 188 S. F. 5438

Contract No. ..... *Exp. Date* .....

Solicitor .....

Name .....

Address .....

"A"

LOAD

Occupied as .....

Incandescent .....

Arcs .....

H. P. .....

Miscellaneous .....

Rate .....

Collection Address .....

With a view of encouraging a desire on the part of the central station to determine the value of "juice" to the agriculturalist when used to supply the necessary water for irrigation purposes or to remove the excess seepage which in rainy seasons is detrimental to the land and the crops, a card of such size as to be readily filed in a cabinet is desirable. This card should contain all the information needed to arrive at the cost per ton of output in fruit crops or vegetables and so on. It should also indicate the type and character of the motor and pumps recorded, with the requisite data on suction and discharge head. The card now in use by one of the large central stations is presented herewith. A careful inspection of the card "B" will prove its broad character and its adaptability for comprehensive and concise information on such instal-

lations as may properly be classed as agricultural.

When considering the advisability of extending transmission lines into a territory as yet, foreign so far as the use of electricity for the house, the barn, for irrigation or reclamation, some utilities endeavor to adapt the card as shown in "A," or some modification of it for use as a prospect card. That confusion is apt to result where legend only is the discrimination between revenue producing business contracted and in prospect, is evident and it is with a view of providing a comprehensive yet convenient prospect record card for agricultural business that the one shown in view "C" is illustrated. That such a record of prospective business and the value of such uses of current as may appeal to the agriculturalist is desired. Such a record results in additional revenue to the central station by this data now available at the utility. It is evident that a broad gauge utility of this nature can never be classified as close-fisted but will thereby secure information as to prospective business or contracting with a rural consumer. It will foresee at once the necessity of an agricultural sales department, unhampered with the red tape of ordinary commercialism and with sufficient latitude in its expenditures as to plan and prepare some authentic information on the sales of current for agricultural purposes.

"B"

FORM N 600

IRRIGATION OR RECLAMATION RECORD | DISTRICT.....

NAME..... P. O. BOX.....

LOCATION TOWN..... TOWNSHIP & RANGE.....

ROAD (LOCATED ON)..... ACREAGE.....

PLANTED TO..... YEARLY YIELD, TONS.....

EQUIPMENT INSTALLED BY.....

H. P. MOTOR..... PHASE..... VOLTAGE..... SPEED..... MAKE.....

PUMP, TYPE..... MAKE..... SIZE..... GALLONS PER MINUTE.....

SUCTION LIFT IN FEET..... DISCHARGE HEAD, FEET..... TOTAL HEAD, FEET.....

COST OF CURRENT PER YEAR..... MINIMUM CHARGE.....

COST PER K. W. HR. FOR CURRENT..... COST PER H. P. PER YEAR.....

AVERAGE HOURS RUN PER DAY..... DAYS PER YEAR RUN.....

CURRENT SUPPLIED BY..... (COMPANY). DATE EXPIRATION CONTRACT.....

REMARKS.....

.....

COMPILED BY..... DATE.....

S. F. 4327

"C"

PROSPECT RECORD NO..... | DIVISION.....

.....

H. P. OF ENGINE..... MAKE..... CONDITION.....

FUEL USED..... QUANTITY PER YEAR.....

FUEL COST PER GALLON DELIVERED.....

REMARKS ON PLANT.....

PUMP..... TYPE..... SIZE.....

REVOLUTIONS OF PUMP..... SIZE OF PULLEYS.....

INSTALLED COST OF PLANT { ENGINE, - - - $..... / PUMP, - - - - $..... / INCIDENTALS, - $..... } TOTAL COST, $.....

OPERATING EXPENSES { FUEL PER MONTH, - $..... / LABOR PER MONTH, $..... / REPAIRS & SUPPLIES, $..... } TOTAL OPERATING EXPENSE, $.....

TOTAL SEASON OPERATING EXPENSE, $..... NUMBER OF DAYS.....

GENERAL REMARKS.....

.....

REPLACED BY ELECTRIC SERVICE, DATE..... (SEE OTHER SIDE)

ELECTRICAL PUMPING AND IRRIGATION

DEPTH OF CUT FOR CANALS IN LEVEL GROUND.

BY B. A. ETCHEVERRY.

Equalizing Cut and Fill.

The cross-section of the canal and its slope being determined, the next step is to determine the depth of digging. This may be fixed so that most of the canal will be (1) within soil or all in cut; (2) above soil or all in fill; (3) partly in cut and partly in fill. In some case where the soil is pervious and not suited to make good banks, where the depth of water may threaten the safety of the canal, or where the canal is on a side hill, it may be necessary to keep within soil. Care must be taken, however, by sinking trial pits that a sandy stratum is not reached by deep cutting, as in this event much valuable water may be wasted by seepage and the waterlogging of the soil may affect the health of the country and ruin land.

Typical Dirt Ditch, Nevada.

In the second case, where the canal is all in embankment, there is always danger of breaks and consequent damage, and also the stoppage of irrigation when required. The embankments must be formed from outside borrow pits, which are always objectionable. This case has the advantage that the water surface is kept above the general level of the ground surface. However, this advantage is only of value for laterals; it will ordinarily suffice if the water level is kept 1.0 to 2.0 feet above ground level; there is usually no advantage in more than this.

The third case has several advantages, especially for canals in level land. When a canal is partly in cut and partly in fill, the water has usually sufficient elevation above the land to give good command into the distributaries, which permits easy application of water to the land. It is also the most economic canal, for the depth of digging can be selected so that the earth excavated from the channel will just suffice for the banks, due allowance being made for shinkage and waste.

The economic depth of digging in level ground can be obtained as follows:

Substituting the known numerical values the equation is readily solved for x.

Let d = total depth of canal section.
b = base width.
a = width of top of bank.
x = economic cut.
m : 1 side slope of water section.
n : 1 side slope of outside of bank.

$\frac{1}{2}$ area of excavation $= \frac{1}{2}\ (b + mx)\ x.$

$$\text{Area of one bank} = \frac{[\,2a + n\,(d-x) + m\,(d-x)\,]\,(d-x)}{2}$$

Assuming 10% for shrinkage and placing, or cut = 1.1 fill; then

$(b + mx)\ x = 1.1\ [(2a + (n + m)\ (d-x)]\ (d-x)$

$bx + mx^2 = 2.2ad - 2.2ax + 1.1nd^2 - 2.2ndx + 1.1nx^2 + 1.1md^2 - 2.2mdx + 1.1mx^2$

$x^2\ (.1m + 1.1n) - x\ (b + 2.2a + 2.2nd + 2.2md) = -2.2ad - 1.1d^2\ (n + m)$

Substituting the known numerical values the equation is readily solved for x.

Field Method of Balancing Cut and Fill for Canal Section in Side Hill. Pivotal Point Method.

When this method is used a stake is first driven at each station at a point where the ground elevation is equal to the elevation of the subgrade of the canal plus the economic cut for a level section and then moved up the sidehill a horizontal distance which will bring it on the center line of the canal and will give the proper balance between cut and fill for the sidehill slope. The purpose of the problem is to obtain the horizontal distance mentioned above. It is worked out for the following special conditions: (1) it is assumed that the uphill canal side slope is equal to the outer or downhill side slope of the bank; (2) it is for a one bank canal. The downhill side slope of the canal need not be the same.

Let
b = base width of canal section.
a = width of top of bank.
d = total depth of canal section.
m:1 = downhill side slope of the canal section.
n:1 = uphill side slope of canal and outer or downhill side slope of bank.
x = depth of economic cut for level section for one bank only.
y = distance from center line of canal to the point on the ground whose elevation is equal to the elevation of the sub-grade of the canal plus x.

The point M represents the position of the grade stake, whose elevation is equal to the elevation of the subgrade of the canal plus x, which is the depth of

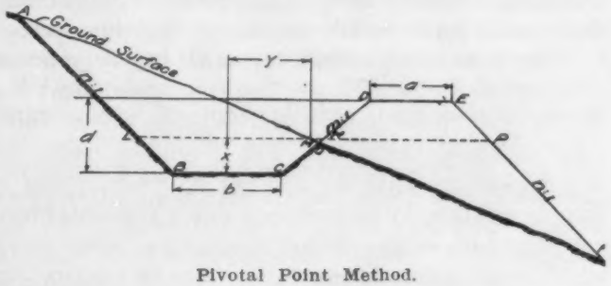
cut necessary in a level section to balance the fill, allowing for shrinkage. Assuming 10 per cent for shrinkage, and that cut LBCN = 1.1 Fill NDER. From this relation the depth of cut x is obtained in the same manner as in the previous problem. This value of x is used to locate the stake at M. The cut ALM must be sufficient to balance the fill ONPF, allowing for shrinkage, but as the triangle MNO is small it will be on the safe side and sufficiently accurate to assume cut ALM = 1.1 Fill. These two triangles are similar and their areas will be in proportion MPF to the squares of their corresponding sides. Therefore,

$$\frac{\text{tri/ALM}}{\text{tri/MPF}} = 1.1 = \frac{(LM)^2}{(LP-LM)^2} \text{ or } \frac{LM}{LP-LM} = \sqrt{1.1}$$

From which

$$\frac{LP}{\sqrt{1.1}} + LM = 1.95\,LM \text{ or } LM = .514\,LP$$

Where LP = b + (n+m) x+ (d − x) (n+m) +a; the distance from the center line to the point M—y—LM — (b/2 + nx) or Y = .514LP — (b/2 + nx). The value of Y remains the same for any given cross section and does not vary with the slope of the side hill. Hence when it is once computed by substituting in the equations the values for the dimensions of the canal, it is used at all the stations unless the cross section is changed. The field procedure is to locate the point M at an elevation higher than the bottom of the canal by the economic cut for a level section from this point measure up the hill the constant distance obtained from the equation, this will establish the center line.



Pivotal Point Method.

Profile of Canal Line and Grade Lines.

The profile of a canal line is obtained from the plot on profile paper of the elevations on the stations. On the profile is generally shown the sub-grade line, the high water line and top of the bank grade line. The difference between the ground elevation and subgrade elevation gives the depth of cut or fill at each station; this is used on the construction survey. On the ordinary canal profile, portions of the canal will be in cut, others in fill, others partly in cut and partly in fill. The profile is used to adjust or determine the grade lines and obtain the depth of cut or fill at each station. Its value depends on the method of location used and on the position of the canal. When the line is that of the diversion canal or of a canal on a sidehill located directly on the ground, without a paper location, such a location is based on the grade and cross section adopted before the survey and the use of the profile will be to permit of a closer adjustment of grades, changing them if necessary, and especially to obtain the cut and fill. When the canal is on sidehill and located by means of a paper location, the profile will be more useful than in the previous case to adjust the grades and cut so as to obtain a proper balance between cut and fill within the limit of economic haul.

When the position of the canal line is fixed by the topography, such as when it must be placed on a ridge or along a boundary line, which is often the case with laterals, then the determination of the correct grade and the proper adjustment of the subgrade line requires a careful study of the profile. If the slope of the country is exactly uniform and equal to the canal grade, then the best position for the subgrade line is parallel to the surface slope and at a depth below it equal to the depth of cut which will give a proper balance between cut and fill. Usually, however, there are more or less inequalities. The following cases often arise: (1) the grade of the canal is parallel to the average grade of the surface of the ground; (2) the grade of the canal is less than the average grade of the ground and it is necessary to use drops.

For the first case the procedure would be as follows:

(a) Draw the surface grade line which will coincide as much as possible with the ground surface. (b) Determine the suitable cross section for the above grade and compute the depth of cut so that the cut will equal the fill. (c) Draw the subgrade line parallel to the surface grade line, below it, at a depth equal to the depth of cut. (d) Draw the high water grade line and top of bank grade line.

For the second case the procedure would be:

(a) Determine suitable cross section, grade and velocity, the cross section and grade being largely determined by the desired velocity. (b) Fix the minimum depth of cut, obtain the average surface grade of the ground surface and find the most economic height of drop, as discussed later. (c) From the height of drop and the minimum depth of cut locate the subgrade on profile.

(To be continued.)

PORTLAND RATE ORDINANCE SUSTAINED.

Application of the Portland Railway, Light & Power Company to the United States District Court for an injunction to set aside an ordinance of the City of Portland fixing the minimum rates that may be charged by gas and electric companies was denied last week by Judge Bean, on the ground that the Federal Court has no jurisdiction in the matter.

In his decision Judge Bean said that since both the corporation and the municipality belong to the same state, there is no diversity of citizenship, and hence the court has no jurisdiction on that ground. Its jurisdiction is sought to be invoked, he says, solely because the provisions of the ordinance deprive the company of its property without due process of the law and impairs the obligations of unexpired contracts existing at the time of the adoption of the ordinance; but the averments of the complaint do not support this contention.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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A Progressive Franchise Policy

Out West one often hears, as in other places, an old saying about taking a horse to water "but you can't make him drink." No more forceful illustration of this can be found than that brought to light in an attempted one-sided regulation of the traffic problem in Western municipalities. Three parties, the harmonious working of which is essential, must be amply protected. Like the primary coils, the magnetic field, and the secondary coils of the transformer, the general public must so regulate the energizing field of force that people, labor, and capital, are interlinked by this field of progressive force—so that maximum energy is transmitted for minimum effort or expenditure. Indeed, a one-sided policy which unnecessarily hampers a utility in its efforts, or which demoralizes or lowers the standard of labor is to be avoided.

Many western cities now find their streets congested with traffic. San Francisco, for instance, has developed in its citizens a riding habit exhibited by no other city in America. Yet, under the present status, progress is impossible. No extensions of street railroads, gas or water pipes, or electric lines can be made. The existing companies, compelled to earn their capital plus profit before the date of franchise expiration, are forced into a selfish attitude, wholly unnecessary for the future good of the city. Amendment No. 34, drawn by three noted traffic experts, will be voted upon on December tenth. The provisions under the new regime are enabling and yet no overstepping of bounds will thereby be made possible. This enactment would provide in the charter the general terms under which municipal ordinances may later be prepared by the Board of Supervisors, subject to the referendum vote. There is also established the foundation for a comprehensive franchise or administrative code, defining in specific terms the conditions and limitations under which all new franchises may be granted by the city to private operators. Most important of all, however, the Board of Supervisors are empowered to carry out a comprehensive resettlement or adjustment franchise policy by means of which existing grants to private operators may be merged into those of new or adjusted grants, which contain specific conditions calculated to remove the present obstacles to adequate service and continued expansion. This amendment should by all means be carried, for if defeated the present stagnation in transportation adjustment must continue for at least two years more.

Amendment six is, on the contrary, wholly unnecessary. This proposed enactment calls for the appointment of a utility commission. We have repeatedly called attention to the mistaken and narrow-minded policy of municipal versus state-wide regulation. Elsewhere in this issue will be found a forceful paper by a Wisconsin commission expert on this self same point. In California a state-wide commission, proven by months of efficient service, now stands ready to meet every phase of the intricate problems before the util-

ity world in San Francisco. Such a state-wide regulation would make a harmonious blending for 1915. For the good of San Francisco in 1915—"now is the time and here is the place"!!

Electrical Equipment of Lift Bridges

Western activity in bridge design is fully apace with other gigantic engineering undertakings in that portion of America. The twenty million dollar bridge interlinking Berkeley, Goat Island and San Francisco will undoubtedly prove an impracticable dream, and even the proposed mammoth bridge crossing the Columbia at Vancouver may be in a somewhat nebulous state of imagination, and again the crossing of the Oakland and Antioch at Chipp's Island may still be unaccomplished, yet the past months have, nevertheless, actually seen the fulfillment of a world-beating feat in bridge design at Portland, Oregon.

Scarcely a bridge has not felt the additional burdens imposed by the concentrated loads incident to the modern automobile and rapid traffic growth in the West. The bridge just completed by the Oregon-Washington Railway & Navigation Company at Portland is the largest double-deck lift bridge in the world. It is the only bridge in existence having a movable lower deck. This pliability wonderfully simplifies traffic congestion which immediately takes place when undue raising of the upper deck becomes necessary.

The bridge has ample use for its two decks. The lower is used to supply double track connections to train service and the upper furnishes two sidewalks, two wagon roads, and double tracks for street cars. The tracks of the lower deck are laid over 6 by 8 in. wooden ties, which are placed on the top of steel girders, while the upper deck is paved with wooden blocks on four-inch planks.

The required government channel clearance is attained by lifting vertically upward a 250 ft. section of the bridge to a height sufficient to give 140 ft. clear space to the high water line. Since all vessels do not require such extreme clearances, remarkable ingenuity was employed in making the lower deck movable while the upper remains in place. Seventy per cent of the vessels passing require less than 70 ft clearance, hence continuity of city traffic is thus materially improved by allowing the upper bridge to remain in tact.

The electrical equipment plays no mean role in the ingenious operation of this world beating engineering structure. In case of breakdowns the control is arranged so that any one, any two, or all four motors may be connected in series or parallel. Suitable clutches are provided to connect the motors mechanically to either lower or upper deck. In case of breakdown, a double throw switch has the flexible possibility of connecting with the electric service supplied from either side of the river. Finally, as a last resort in case of accident, the bridge mechanism is provided with suitable levers so that hand operation is possible.

Excellent control is also installed for making the operation of the bridge fool-proof. The current cannot be turned on to the motors which operate the upper deck until the locks have been opened and the deck is free to rise. Again, the current cannot be turned on to the same span until the lower span is raised to its highest point and properly locked by the solenoid brakes on its motors. Limit switches also cut off the current when the limit of travel of the decks has been reached, and finally, signal lights automatically indicate the heights of travel. Definite governmental instructions are thus flashed to all observers.

The bridge made its first one thousand trips without requiring adjustments and today stands as a monument of enterprise to the city of Portland and a credit to all having a part in its construction.

Water in Fuel Oil

An article on methods of water determination for fuel oil, appearing elsewhere in this issue, recalls to mind the combustion losses due to presence of water in fuel oil, and the present status of processes whereby water in emulsion may be taken from the oil.

That water in fuel oil is not passive but, when appearing in certain proportions may be shown to be a formidable draw-back for efficient combustion in the boiler furnace, must be admitted. Let us, however, examine. Assume for instance that the fuel oil, containing 20 per cent water, either in the free state or in emulsion, is taken from the storage tank at 60 degrees F., and finally that the products of combustion leave the chimney at 500 degrees F. Evidently in the process of combustion of the oil this water must be evaporated into steam at atmosphere pressure and then superheated to 500 degrees F., all of which is at the expense of the heat given out by each pound of oil. Thus, to raise the temperature of a pound of water from 62 degrees F. to 212 degrees F. requires 150 B.t.u.; to evaporate into steam at atmospheric pressure requires an additional 970.4 B.t.u.; and, finally, to superheat to 500 degrees F., 135 B.t.u. must again be added. Hence, in all is required some 1255.4 B.t.u. Twenty per cent of this amounts to 250 B.t.u. per pound of fuel fired. California crude petroleum usually averages about 18,500 B.t.u. per lb. Hence there is wasted 1.5 per cent of the heating value of the fuel. This needless waste takes place, even if the far surpassing costs of transporting this surplus bulk, were neglected.

In almost all oil fields water-bearing strata are found either above, below, or sandwiched between the oil sands. To remove that proportion appearing as free water by simple gravity setting is an easy task. Water in emulsion, however, often running as high as 30 per cent of the mixture, is indeed a difficult problem of solution.

It is interesting to note that electricity has again solved this, another riddle, in the engineering world. Oil containing water in emulsion, when exposed to a highly attenuated magnetic field, forms a chain of globules or water drops, between the electrodes. Canvas is interposed, which—mirabile dictu—catches the water but is absolutely insensible to oil. Hence the segregation is accomplished. Thus is it made possible to sell more electricity in order to make more commercial oil, in order to generate more electricity—surely this is a forceful illustration of casting bread upon the waters.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

T. E. Bibbins has been reappointed Jovian Statesman at large by **Frank E. Watts.**

E. C. Hutchinson, sales engineer with the Pelton Water Wheel Company, is in Washington.

W. F. Lamme, consulting electrical engineer at San Francisco will visit Pittsburg and New York City within the next two weeks.

E. B. Bumsted, vice-president of the Oro Electric Corporation, has returned from a brief trip East and spent most of the past week at Oroville, Cal.

E. P. Edwards, engineer with the lighting department of the General Electric Company, and a specialist on the application of electricity to the farm, was in San Francisco during the past week.

W. E. Erwin, formerly assistant superintendent of the San Bernardino (Cal.) division of the Pacific Electric Railway, is now superintendent for the Santa Barbara Consolidated Electric Railway Company.

R. B. Clapp, representative of the Westinghouse Electric & Manufacturing Company at Los Angeles, has been appointed Statesman of the Jovian Order for Los Angeles by **Frank E. Watts** of New York City, Eleventh Jupiter.

Wilber E. Coman, at present general freight and passenger agent for the North Bank and affiliated railroads, has accepted the position of vice-president and general manager of the Northwestern Electric Company at Portland, Ore.

F. G. Baum, engineer in charge of the Pacific Gas & Electric Company's hydroelectric development at Lake Spaulding, spent the past week inspecting the Los Angeles Aqueduct, in company with **P. M. Downing** and **H. C. Vensano.**

C. Walter Jones, formerly sales manager with the Holophane Company, has been appointed commercial manager for the Utah Light & Power Company at Salt Lake City. He has returned to Salt Lake City after making a brief visit to California.

Cyril J. Atkinson, inventor and patentee of the Atkinson gas producer, has severed his connection with the Dornfeld-Kunert Company of Watertown, Wis., to become associated with Fairbanks, Morse & Company, who have been given the use of all his patents.

C. E. Patterson of the auditing department of the General Electric Company, is making a tour of inspection of the Pacific Coast. On his trip from Los Angeles to San Francisco he was accompanied by **R. J. Cash Jr.,** manager of the company's Los Angeles office.

W. Brewster Hall, Pacific Coast manager for Pass & Seymour, left San Francisco this week for a two months' trip during the course of which he will call on the trade in Southern California, visit the factory at Solway, N. Y., where communications may be addressed to him, and return in February by way of Seattle.

F. O. Dolson has resigned his position with the engineering department of the Pelton Water Wheel Company to enter the employ of the Pacific Power & Light Company of Portland in a considerably broader field. Many of the most successful power plants on the Pacific Coast give evidence of the high quality of Mr. Dolson's work and his new field of activity is one that will be greatly benefited by his services.

A. L. Menzin has opened an office as mechanical and electrical engineer in the Sheldon Building, San Francisco. In addition to his long association with the Tracy Engineering Company, Mr. Menzin had considerable experience in the East, also being a graduate from the University of California. He is well known as a contributor to the technical press, his articles displaying the most profound and penetrating thought. His many friends unite in wishing him success.

Frank N. Killam, for the past three years travelling representative of the Pacific States Electric Company in California, is the manager of the new branch which the company has opened at Seattle. **E. A. Norton,** formerly with the San Francisco house, is division sales manager, and **W. H. Ayden,** cashier and credit man. Practically the entire sales force of the Holabird Electric Company, which has been taken over by the Pacific States Electric Company, has been retained.

Stanley V. Walton, western chairman of the N. E. L. A. committee on Electricity on the Farm, has called a meeting for December 7th, at Fresno, Cal. **Frank W. Balfour,** district agent for the Southern California Edison Company at Pomona, has been appointed by S. M. Kennedy of the company, as his representative on this committee. Mr. Walton has also prepared a paper on "Electricity on the Farm" to be presented at the Oroville meeting of the Counties Committee of the California Development Board of the same date.

Warner M. Skiff, for three years assistant manager of the engineering department, National Electric Lamp Association, has been appointed manager of the engineering department of the Association to succeed **Glenn C. Webster,** who has assumed the managership of the Tungstolier Works of General Electric Company.

Among those attending the meeting of the Pacific Coast Electrical Jobbers' Association at Catalina Island this week are the following from the North:

W. Brewster Hall and wife,
F. H. Leggett and wife,
T. B. Hyde and wife,
C. E. Wiggin,
C. C. Hillis,
F. H. Poss,
Miles Steel,
C. R. Dederick,
H. V. Carter,
R. J. Davis,
C. C. Hillis,
H. E. Sanderson,
E. B. Strong,
J. A. Herr,
F. N. Averill,
Garnett Young,
C. L. Gilson,
T. E. Bibbins,
T. E. Collins,
Frank Fowden,
A. H. Elliott.

In addition there is a large attendance of Los Angeles electrical men, promising to give one of the most successful meetings. Besides the usual trophies, Walter H. Seaver, Pacific Coast Manager for the American Steel & Wire Company, personally presented a handsome silver trophy to be awarded to the man making the highest aggregate golf score.

SPOKANE JOVIAN LUNCHEON.

At the regular luncheon of the Spokane Jovians on November 26 H. L. Bargion of the Washington Electric Supply Company, was chairman of the day, the speaker being Honorable W. J. Hindley, mayor of Spokane, who gave a very interesting and instructive address on the "Benefits of Organization." A discussion to prohibit liquor at rejuvenations, led by V. G. Shinkle of the Washington Water Power Company, resulted in a vote and the motion was passed, that it is the sense of the Jovian Order that there be a total abstinence of all liquor at the rejuvenation and banquets. Statesman C. R. Bean has appointed Mr. Haggenmiller, assistant purchasing agent of the Washington Water Power Company, as alternate statesman for Eastern Washington, and as a committee on rejuvenation, H. J. Tinkham of the Pacific Telephone Company, W. A. Davis, city electrical inspector, and Mr. Hungate, chief electrical engineer of the Inland Empire System. He also appointed H. W. Peterson as toastmaster for the banquet at the rejuvenation.

The following Jovians will constitute the degree team for Rejuvenation Night:

Jupiter—V. G. Shinkle, Washington Water Power Company.

Neptune—H. L. Bargion, Washington Electric Supply Company.

Pluto—J. H. Jamieson, Westinghouse Company.

Vulcan—S. E. Gates, General Electric Company.

Mercury—A. C. Haggenmiller, assistant purchasing agent Washington Water Power Company.

Hercules—W. A. Davis, City Electrical Inspector.

Mars—Milliard Sebern, Washington Electric Supply Company.

Apollo—R. S. Kemp, Washington Electric Supply Company.

Avrenrim—J. R. Mitchell, Doerr-Mitchell Electric Company.

H. Robsheit of the Westinghouse Company will preside at the piano that night.

The Rejuvenation and Banquet will be held at 7:00 p. m. on December 7th, in the main dining room of the Inland Club

MEETING NOTICES.

San Francisco Jovian Club.

The regular weekly luncheon of the San Francisco Jovian Club was held on Tuesday, December 3d at Tait's Cafe, R. R. Alvord being chairman. The subject of the day was an illustrated lecture on Ornamental Illumination by C. R. Wallis. A drawing was held for an electric coffee percolator, Mr. Talent being the "lucky man." The newly appointed Statesman, A. H. Halloran, briefly outlined plans for the ensuing year and suggested that a discussion be held at an early date on the advisability of prohibiting liquor at future rejuvenations. This suggestion was adopted and the matter will be the subect of a discussion at an early meeting. The next meeting will be held on December 17th. All visiting electrical men are invited to attend.

Portland Engineers' Club.

The regular engineers' luncheon was held at the Portland Hotel, Tuesday, November 26. The chairman was H. G. Beckwith of the Portland Architectural Club. The speaker was E. P. Miche, superintendent of the Public Parks of Portland, Oregon. The subect of his talk was "Needs of a City as Regards Boulevards and Parks."

CALIFORNIA ASSOCIATION OF AUDITORS AND ACCOUNTANTS OF PUBLIC UTILITIES.

On Saturday, October 5, 1912, the California Association of Auditors and Accountants of Public Utilities was organized, with the following officers and board of directors: President, M. H. Bridges; Vice-President, B. T. Story; Secretary, H. E. Nowell; Treasurer, F. A. MacHugh.

Charter Members and Board of Directors: W. B. Bailey, Auditor Great Western Power Company; F. J. Blanchard, Auditor Sierra & San Francisco Power Company; M. H. Bridges, Auditor Pacific Gas & Electric Company; A. Herrick, Certified Public Accountant; W. E. Houghton, Auditor Los Angeles Gas & Electric Corporation; A. H. Kayser, General Auditor Spreckels Companies; A. Lambie, Pacific Coast Auditor H. M. Byllesby & Company; F. A. MacHugh, Special Accountant United Properties Company; H. E. Nowell, Auditor Oro Electric Corporation; C. P. Stall, Auditor San Joaquin Light & Power Corporation; B. T. Story, Auditor Southern California Edison Company.

This organization was the outgrowth of a committee appointed by the Railroad Commission of the above representatives of public utilities for the purpose of discussion of a tentative classification of accounts presented by the Commission for gas and electric companies. The benefits of each individual representative resultant from the various committee meetings and discussions held, demonstrated the benefits which would be derived from a permanent organization.

This committee was successful in presenting to the Auditor of the Railroad Commission definite recommendations as to the scheme of accounts proposed, and it was found desirable to perpetuate the common interests which may be taken up by a permanent organization.

It will be possible for this Association to hold meetings for discussion of papers presented by members, or have addresses made and papers read by visiting economists and accountants of national repute.

The effort of the present organization is to obtain a representative membership from all public utilities in California, inclusive of electric railroad companies, express companies, pipe line companies, gas companies, electric companies, telephone companies, telegraph companies and water companies; and to this end we have effected the above organization until the regular annual meeting held March 29, 1913, at which time the officers and directors for the ensuing year will be elected. It is hoped to have a representative directorate and official body elected at this meeting. This meeting will present an opportunity for the participation of all new members within a few months of the organizing of the association and will have the effect immediately of presenting a policy and program of the association outlined by a majority membership.

As the qualified membership represented at the annual meeting will be limited to those members who have been accepted by the board of directors prior to March 29, 1913, the date of the annual meeting, it is desirable that the membership be as complete as possible by that date, in order that the 1913 program may be outlined by a representative body and provide immediate working funds.

CONFERENCE ON WATER POWER REGULATION.

John M. Eshelman, president of the California Railroad Commission, has returned to San Francisco from a national meeting of railway commissions and from a conference with Secretary Fisher of the Department of the Interior. A two-days' conference was held with representatives of some of the large power companies on November 18 and 19, Prof. Chas. D. Marx of the California Water Commission, also being present.

Representatives of the power companies urged the policy of local rather than federal control. Secretary Fisher favors the distribution of the benefits of natural resources to the ultimate consumers in the form of lower rates and better service. Where steam competition is not present and competition between waterpower sites is abolished, effective regulation of the resulting monopoly is quite possible, but, in his opinion, the power to charge rentals should be preserved to the federal government because defective state laws or lax administration may fail to protect the public from extortion.

The new regulations insure state control of rates and service by a provision that failure to obey reasonable requirements made by state authorities shall be deemed adequate cause for revocation of the federal permit.

There was some criticism of the details of the regulation which binds the permittee to sell at a fair valuation to the state or any municipality desiring to purchase, but the correctness of the general principle was admitted. The desirability of some impartial and effective method of determining valuation in such cases was conceded by the federal officials. Secretary Fisher said that his department approves of the general provisions of the pending Burton bill to regulate waterpower development on sites owned by the federal government and considers them consistent with the regulations under discussion and in accord with the views generally expressed at the conference. He also requested specific criticism of the measure before the Interior Department responds to the formal request from the Senate committee on commerce for report thereon. It is believed that one outcome of the conference is likely to be simplified procedure, whereby state and federal officers will act in harmony and with dispatch.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

THE RELATION OF THE OREGON ELECTRICAL CONTRACTOR TO THE UNDERWRITERS' INSPECTION WORK IN OREGON.[1]

BY F. D. WEBER.

When Thomas Edison invented the incandescent lamp in 1880 a new era was immediately opened in the illuminating field. The present day electrical contracting business was then born as a direct result of the inventions that made electricity practical and a necessity. Afterwards it seems to have drifted along for years as a part of this wonderful development, but without any specific effort being made to raise its standard as a business until the National Contractors' Association was formed.

The business within itself is as diversified as is possible to imagine. The individual contractor's scope varies from the "carpet bagger" to the great power plant contractor and builder. Therefore is it any wonder that it is a most difficult task to bring this diversified group into one organization and establish ideals for them and have these ideals become well rooted in such a short space of time.

The electrical contractor must have ideals. He must have instilled a burning desire to raise the standard of "electrical contracting." This desire must come from within the heart of every contractor and be never laid aside for a second. Just as soon as the contractors of Oregon are in "dead earnest" and announce that they mean business immediately the tide will turn in their favor and a new era will be with us.

We all know that in the past the electrical contractor has always received the worst of the deal. Starting from the specifications written by the architects and continued by the superintendent on the job, he is given about as little consideration as is possible to conceive.

During all these thirty-odd years, there has always been organizations in this country which have been staunch friends to the electrical contractor as long as he endeavored to follow a legitimate course. These organizations are the various Underwriters' organizations throughout the United States.

The Underwriters' attention was forcibly called to the necessity of electrical inspection as early as 1881, due to the fact that twenty-six electrical fires occurred in six months in the sixty-five textile mills of New England. They immediately formulated local rules to handle the situation, from which grew the N. E. C. as we have it today, being first adopted as such in 1896.

Therefore the National Electrical Code is the product of early and continued cooperation in the early days of electricity between the various electrical and insurance interests, and has been so well guided as to be today the most widely accepted material standard in the world and the code of specifications most widely incorporated into ordinances. Therefore you see the Underwriters have endeavored by the aid of all other national organizations to set a standard below which no workmanship or material should fall.

Nothing is said as regards exceeding this standard in perfection, consequently the electrical contractor has the liberty to approach perfection as near as he desired, but it is astonishing to see how little thought is expended by him in striving to exceed this minimum standard.

In connection with the N. E. C. there is maintained in Chicago the Underwriters' Laboratories, Inc. No other country has the benefit of a system like this. The Canadian Underwriters are now using the laboratory reports as their authority on material and fittings. The laboratories are now dispensing labels at the rate of 20,000,000 per annum.

There has never been any organization except the Underwriters in this country which has ever taken decided steps to advance the standard of materials and fittings. Do you ever hear the jobbers say we will not handle a fitting or a material, because it is not the best one we can get. They only stop when the Underwriters refuse to pass them and many times they handle it on the quiet, anyway. You must remember the Underwriters are in business too, and many times lose business by an increase in insurance rates, still you will find that all over the United States they are willing to sacrifice the business, when they are sure they are in the right.

The methods the Underwriters have used in the past in Oregon are quite clear to a great many of you, i.e., An inspector will visit a town or city, go through all the business risks and any special risks—such as saw mills, flour mill, etc.—and make a list of all electrical defects. Then when he returns to the office all the owners and tenants are notified by him in writing. Then after a reasonable time, over 30 days, the town is re-inspected, and if no attempt has been made to correct the defects a readjustment of the insurance rate is made, generally 25 per cent increase. Moving picture booths construction are also inspected and charges made for defective installations.

If at any time after the increase in the rate the inspectors had received a letter, or in other words a certificate, stating that the defects had been corrected according to the requirements of the N. E. C. the rate is reduced, subject to an inspection by this office. This certificate should have been made out by the local city electrical inspector, or in the absence of this official by some person connected with the electrical contracting business, or representatives of the power company. Printed reports in all towns and cities were sent to all the managers of the various insurance companies.

After the Board of Fire Underwriters of the Pacific withdrew from Oregon, country inspection was discontinued for about two years, but beginning with the first of this year we have again commenced this work under the new organization, known as the U. E. R. Bureau. Our old system was unsatisfactory from our own standpoint and from the standpoint of the owners, tenants, and electrical contractors. Consequently in the last year we have been endeavoring to develop a new system of inspection, and after investigating the systems used in the older jurisdiction believe we are now on the right road and have devised a system which will be thoroughly satisfactory.

The things to consider in devising a system of inspection are the following:

(1) The amount of labor required to place the defects under a system—in field and in the office.

(2) Flexibility of the system as regards addition of new defects and the addition of new buildings in the town and cities inspected.

(3) Simplicity of the office system, so that anyone in our office, not an electrical engineer, can find the defects on any risk.

(4) Simplicity and ease of understanding for the layman, as well as for the electrical contractor.

(5) Avoiding mistakes on the part of the layman and contractor, by double meaning being attached to any defect pointed out.

[1]Paper to be presented at the Oregon Electrical Contractors' Convention, Portland, Oregon, December 17 and 18, 1912.

(6) Return of a proper certificate of correction, signed by the proper party, as we do not accept owners' or tenants' signatures on same.

(7) Ability of formal notice to make the proper impression on owners and tenants and get the corrections made immediately without forcing same by rate adjustment.

(8) A method of protecting owners and tenants from the operation of crooked contractors by having the contractors' statements of proper correction in writing.

(9) Division of responsibility between the contractor, local city inspector and bureau inspector for proper correction.

(10) A means by which to adjust rates without inspection, thereby giving honest correction of defects the advantage of the best rate possible, and at the same time not nullify our original notice.

(To be continued.)

CONDUIT CONSTRUCTION.

It is very evident that the tendency of the times on the part of architects, engineers, inspection departments and municipal authorities is toward the requiring of metallic conduit for the installation of wires in buildings.

Recognizing this tendency the National Electrical Contractors' Association, through its executive committee, has been working on the preparation of reliable data in regard to the proper size of conduit to be used in installing wires and cables.

The disposition in the past has been to use conduits of too small interior diameter, and in the preparation of these charts care has been taken to recommend conduits of sufficient size to cover all their conditions, and at the same time having in mind that the economy in installations should be considered and extravagant sizes in conduits not recommended. We therefore, feel that the sizes recommended are sufficiently large and at the same time conservatively calculated.

Very nearly a year has been spent in the study and investigation of this subject, and this has resulted in the preparation of charts showing in full size the proper sized conduits to be used for installation of various combinations of wires and cables, and those charts were officially adopted at the Twelfth Annual Meeting of the National Electrical Contractors' Association.

The charts show the conduit and conductors in full size, and the prints are made from plates so that there can be no variation in size, and the sheets are mounted on heavy board with an eyelet at the top for convenient hanging.

In addition to showing the size conduit needed for such combination of wires, the charts give the actual external diameter of the conduit, and the carrying capacity of the wires shown.

The complete set comprises six charts, and shows the proper size of conduit for one, two, three, four convertible three-wire systems; combinations of duplex wires in sizes No. 10, 12 and 14 B. & S. gauge; single wire combinations of No. 14 B. & S. wire up to ninety wires; combinations of No. 16, No. 18 B. & S. fixture wires up to one hundred and fifty wires, and combinations of telephone wires up to fifty pairs.

This covers practically all of the data required for the installation of wires and conduits, and presents it in a form most convenient for use.

The advantage of a standard system is self-evident from the standpoint of the architect, engineer, and contractor, and it is the hope of the National Electrical Contractors' Association that those having to do with the installation of conduits will accept the charts as prepared and write into their specifications that, "the sizes of all conduits shall be the N. E. C. A. standard."

The National Electrical Contractors' Association has borne the work and expense of the preparation of these charts and in the interest of standardization is prepared to furnish these charts at the actual cost of producing them, and will forward a set securely boxed f.c.b. Utica, on receipt of $2.25. Orders for them or requests for further information should be sent to W. H. Morton, Secretary, 41 Martin Bldg., Utica, New York.

SAN FRANCISCO ELECTRICAL CONTRACTORS' NOTES.

The Standard Electric Company was awarded the wiring for the Starr King school for the sum of $1924.

John G. Sutton Company has nearly completed installing the feed wires for the Geary street road.

The Buyers' Reference Catalogue that is being gotten out by the committee appointed by the contractors, will be mailed at the end of next week. Anyone desiring one of these books can obtain same by notifying W. S. Hanbridge, 1408 Merchants' National Bank Building.

President John Rendler and Secretary W. S. Hanbridge held a meeting in Fresno November 29 and took up several matters of importance to the State Association.

The draft of the state license law will be placed in the hands of an attorney so that the same may be in proper shape to present to the legislature in January. Assemblyman Scott will present the bill to the Assembly.

The matter of extending the conduit ordinance throughout the city, which was presented by the Contractors in August, was taken up by the Building Committee Tuesday. Messrs. Hanbridge, Watts and Deleiu represented the Contractors; Messrs. Brumfield and Porter the sign men; Messrs. Nixon and Fish the Department of Electricity, and G. I. Kinney the Electrical Development League. At his request the matter was taken under advisement by the Building Committee. The principal reason the Contractors are anxious to get conduit throughout the city is because at the present time they are required to run wires in conduit in all buildings in the fire district. The result is no job of wiring can be done at the present time without the use of some conduit, thus bringing the average up to about 75 per cent of the work installed in conduit at present.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC.

New York City, Dec. 4. 1912.—The Organization Committee for the Society of Electrical Development, Inc., met at New York City on December 2. Considerable progress in development plans was reported, but the variety of interests to be considered still necessitate a great deal of work by the committee before the suggestions will be concrete enough to present to the industry at large. A sub-committee on finance and administration for further organization work was appointed. Sufficient funds were advanced by members of the organization committee for this purpose. The next meeting will be held in January.

EDITORIAL NOTES.

In connection with S. M. Kennedy's articles on "Justification of Rate Regulation" as published in these columns last week, mention should have been made that this had been read as a paper before the employes of the Southern California Edison Company as it relates simply to local conditions and is intended to be general in its scope.

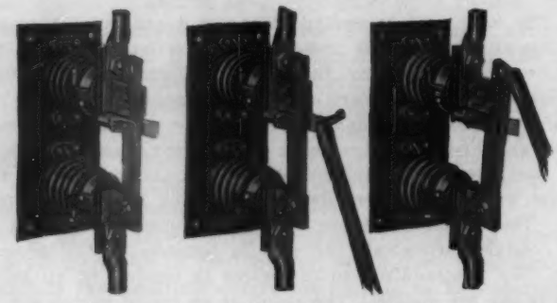
In connection with H. J. Kennedy's article on "Woodstave Pipe Construction" in the issue of November 9th, on page 403, the price of coal should have been stated as being less than $4.00 a ton instead of less than $3.00 a ton.

INDUSTRIAL

SAFEGUARDING CONTINUITY OF ELECTRIC POWER SERVICE.

At the present time, the ubiquity of electricity is practically an accomplished fact. To realize how dependent the people are upon the electric current, it is only necessary to be at the power house end of the telephone when the power is off and an exasperated public has waited for what they consider a reasonable length of time for its restoration. A shutdown of the machinery may mean not only serious delay in finishing work, but also men paid high wages standing around idle. This condition makes it imperative that every device be employed which makes for continuity of service.

The illustration shows a locking device, manufactured by The General Electric Company, that effectually prevents the blade of a disconnecting switch from opening except under the direction of the operator. Instances are on record where the blade of a disconnecting switch not protected by this device has been thrown open or partly open by magnetic repulsion and destroyed when a short circuit has occurred on the line, not only resulting in the loss of the switch, but also putting the circuit on which the switch was installed out of commission till a new switch could be installed, unless there were duplicate circuits.



Disconnecting Switch with Locking Device.

The safety catch or locking device is a unit in itself and can be applied by anyone to any GE type L, for G-6 switch merely by clamping it to a support placed between the clip block and the insulator cap. It is of rugged design and is operated with a switch hook. This locking device consists essentially of two brass bell cranks hinged together at the ends of the two shorter arms and held closed by compression springs. The projections or jaws in the outer ends of the two longer arms close in front of the blade, thus preventing the latter from coming out of the clips. Each bell crank is provided with a dog which moves in a slot in the bell crank's elbow, the dog being hinged at this point. Two compression springs, one pressing outwardly from the switch base against the elbow of each crank and also against the dog, keep the bell cranks closed and the dogs pressed against the back of the switch blade.

To open the switch the outer ends of the bell cranks are pressed back away from the blade, allowing the dogs to come forward so as to rest upon the sides of the blade, in which position they hold the jaws in front of the blade apart, allowing the switch to be opened. Withdrawing the blade of this switch from between the dogs causes the jaws to automatically close against the sides of the blade and to snap shut as soon as the blade is completely withdrawn.

As the outer edges of the jaws are beveled, the switch blade can be readily pressed back in the clips into the closed position, when the jaws close automatically in front of the blade, locking the latter in the closed position.

NEW CUTLER-HAMMER PRINTING PRESS CONTROLLERS

Direct-current types of the Carpenter type printing press controllers have long been widely used for the control of flat-bed presses. For use where alternating current only is available, the Carpenter type controller illustrated in the accompanying view has been developed and placed on the market by The Cutler-Hammer Manufacturing Company, Milwaukee. It is suitable for the speed control of slip ring induction motors driving printing presses, machine tools, etc. These controllers provide for seven forward speeds and two reverse speeds. They are suitable for either three-phase, three-wire, or two-phase, either three-wire or four-wire motors having

A.C. Printing Press Controller.

three-phase rotors with secondary current not exceeding 60 amperes per phase. Standard designs allow for 50 per cent speed reduction under full load conditions.

The mechanism is enclosed in a rugged cast iron case with a removable cover. The operating handle projects from a slot in the top of the enclosing case and provides easy means for operation. The terminals are easily accessible.

The resistance, except in the cast of the 7½ h.p. size, is all contained on one plate divided into three sections, so that speed variations are obtained by inserting equal amounts of resistance in the rotor circuits. The Carpenter resistance plate can be installed under the press or machine without danger.

BOOK REVIEW.

Questions and Answers on the National Electrical Code. By T. S. McLoughlin. 232 pages, leather-bound pocket-book. Published by McGraw Hill Book Company, New York, and for sale by Technical Book Shop, San Francisco, Cal. Price, $1.00.

This manual is written as a guide to the National Electrical Code for the use of wire men, contractors, architects and engineers. It is arranged as a series of questions and answers, each answer being followed by the number of the corresponding code rule upon which it is based. The book is divided into nine sections so that it is possible to get all the rulings on any subject under that heading. These are as follows: Generators, transformers, outside work, signalling systems, arc lamps and series systems, inside work, electric railway systems, marine work, code requirements on wire and material. This is an excellent start along the right direction. But as it is somewhat difficult, perhaps, to give positive answers to many of the questions, it would have been well to have qualified the bare "yes" or "no," which is frequently employed. The text will prove of great assistance to electrical contractors.

NEWS NOTES

ILLUMINATION.

EL CENTRO, CAL.—A franchise has been granted here to the Imperial Valley Gas Company to construct and maintain for a period of 50 years, a system of gas pipes.

LOMPOC, CAL.—Messrs. Weber & Wagner of Los Angeles, representing a group of capitalists, have applied to the town board for permission to construct and operate a gas plant here.

OAKLAND, CAL.—As a step in carrying out the plan to light East Fourteenth street, with electroliers or gasoliers from Central Oakland to the city limits beyond 107th avenue, the city council has authorized the placing of 34 gasoliers between 82d and 98th avenues.

TROPICO, CAL.—Sealed bids will be received up to January 2d, for a franchise granting the right to lay a system of pipes and pipe lines for a period of 40 years, in and under the public streets of Tropico, together with right to furnish gas through said pipes for that period.

PENDLETON, ORE.—Pendleton will not have a municipal power and light plant in the near future, all plans to acquire a power site on the Walla Walla river having been abandoned, when the council voted to return the option which it has held for the past half year.

LAS VEGAS, N. M.—The city council accepted plans of the proposed contract of the Las Vegas Light & Power Company, providing for a new system of street illumination. According to W. P. Southard, manager for the power company, the new lamps will be installed by January 1.

ANTIOCH, CAL.—An application has been made by the Great Western Power Company for a franchise to erect lines, wires, etc., for the transmitting of electricity in the town of Antioch, for furnishing light, heat and power. Sealed bids will be received up to January 13th, for the sale of said franchise.

TELEPHONE AND TELEGRAPH.

CARPENTERIA, CAL.—It is understood that the Sunset Company is planning to install a fully equipped central office here within 90 days.

LOS ANGELES, CAL.—Utilities board has taken under advisement the application of the American District Telegraph Company for a franchise to lay conduits in the city streets.

SOUTH PASADENA, CAL.—The Home Telephone Company has announced proposed improvements which include the installation of about 100 miles of cable in this city, and the removal of all duplicate poles.

SAN JOSE, CAL.—The town of Mountain View has sent to the Railroad Commission an order of the Pacific Telephone & Telegraph Company establishing Los Altos, two miles away, as a long distance station and charging for switches. Mountain View's switching privileges have always been limited to a short distance in the surrounding country, while Sunnyvale, its neighbor, has free local service as far as San Jose. Los Altos is to have a switchboard and will be a long-distance toll station.

SAN DIEGO, CAL.—Work on excavation for the conduits which are being put in by the Pacific Telephone & Telegraph Company and will extend from Seventh to Twenty-fifth street, has begun, about 150 men being put to work on the job. The new underground line will be a 6-duct conduit and each will carry 600 pair or 1200 wires enclosed in cables. The cost is estimated at about $23,000. When this work is completed, a 4-duct conduit will be laid from University to El Cajon avenue, to carry 1200 wires each, or 4800 in all.

SAN FRANCISCO, CAL.—An affidavit purporting to divulge the internal transactions marking the merger of the Pacific Telephone & Telegraph Company with the Bay Cities Home Telephone Company, and containing allegations of a corporation which existed for two days only and of the burning of records of the Home company, was brought to light Saturday, but disappeared later in the day. The document was signed by E. C. McDonough, who set forth that he was vice-president of the "Home Long Distance Company," the corporation mentioned. It was first offered as an affidavit before Judge Trabucco, who is sitting for Judge Lawlor in the injunction suit brought by O. L. Scott against the Pacific company to prevent it from dismantling the plant of the Home company. Trabucco rejected the document on the ground that it had not been offered in time. Then it was introduced in the office of the county clerk, where it was placed for filing, but was withdrawn later in the day before it had become a matter of record. Judge Trabucco took the injunction case under advisement, promising a decision at an early date.

TRANSMISSION.

NEW WESTMINSTER, B. C.—The city council will receive tenders from the Western Canada Power Company and the Vancouver Power Company, until December 23, for supply of power for this city.

CONCRETE, WASH.—The Northwest Traction Company has been granted a 50-year franchise to construct and maintain power wires through this city. The concern named will furnish power for the Washington and Superior Portland Cement Companies.

SATSOP, WASH.—The Montesano Light & Water Company and the Elma Light Company have petitioned the county commissioners for a permit to run an electric line along county road to Satsop and upon streets of the town. The matter comes up for final hearing December 2.

SAN BERNARDINO, CAL.—Plans are about completed by Pacific Light & Power Company to build a 60,000 volt power line direct to San Bernardino from its big distributing station at Eagle Rock. The line will be built on Base line eastward to A street, forming a loop of the valley, it being proposed to extend the line south to Colton, Riverside and then west to Dominguez near San Pedro.

TONOPAH, NEV.—For the second time in three weeks the substation of the California-Nevada Power Company here was burned out Saturday, shutting down all mines and mills. The damage is estimated at $20,000. The first fire was caused by a short circuit in one of the converters. Repairs had been practically completed when a workman dropped a piece of wire netting across a high tension power line.

TRANSPORTATION.

SAN DIEGO, CAL.—The San Diego Electric Railway Company has been granted a franchise to construct a street railway upon certain public streets in this city.

COEUR d'ALENE, IDAHO.—The freight depot of the Spokane & Inland Railway Company electric line burned here recently. Loss nominal. The depot will be rebuilt immediately.

SAN BERNARDINO, CAL.—The last deeds for the right of way for the Pacific Electric's Riverside-San Bernardino line have been filed for record, and construction work is expected to commence this week.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company proposes to extend the Madison street car line from Broadway to Fourteenth avenue at a cost of approximately $125,000. Work will begin at once.

VANCOUVER, B. C.—Chief Engineer Conway of the British Columbia Electric Railway Company, is having plans drawn for a $30,000 station to be built at the south end of the Granville street bridge to serve patrons of the Eburne interurban lines.

EL PASO, TEXAS.—The Stone & Webster Corporation of Boston and the El Paso Electric Railway will be presented with franchise and deeds for the right of way for interurban electric railway to Ysleta, which will ultimately run east from El Paso in the Rio Grande valley. Construction work will begin as soon as possible.

ROSLYN, WASH.—Simon Justham, promoter of the Kittitas Railway & Power Company, is authority for the statement that the concern named will start actual work of constructing the proposed electric line from Cle Elum to Cle Elum mining district in the spring. French capitalists in Paris purchased bonds in the sum of $2,400,000 to finance the project.

LOS ANGELES, CAL.—It has been announced by Pacific Electric officials that the contract for grading the roadbed for the Pacific Electric extension from San Bernardino to Riverside by way of Urbita and Colton has been awarded to Robert Shereer & Company of Los Angeles, and the contract for bridge construction to Charles W. Corbaley of Los Angeles.

SAN FRANCISCO, CAL.—A special fund into which shall be paid all receipts from the Geary street road has been created by the supervisors. The first contribution was $10,000, transferred from the municipal railroad bond fund. This was set aside by the finance committee, at the request of Superintendent Cashin, for initial equipment and operating expenses. As soon as the railway is earning money the $10,000, which is in the nature of a loan, will be paid back into the bond fund.

SAN FRANCISCO, CAL.—Some time ago the Southern Pacific Railroad ordered fifteen 50-ton electric locomotives to be used for freight and switching service. The first one of these locomotives has just been completed. They are equipped so that they may be operated on either a 6000 or 12000 volt direct current, and if necessary they can be used for passenger service as well as for freight and switching. The Baldwin Locomotive Works built the mechanical parts at its Philadelphia plant and the Westinghouse Electric & Manufacturing Company constructed and installed the electrical equipment at its East Pittsburg works.

VALLEY SPRING, CAL.—It is understood that capitalists of San Francisco have become interested in the electric line surveyed from Mokelumne Hill to this point via the W. B. Clark marble quarry. Clark, it is understood, will back the movement for a new line and the survey party says other moneyed men will invest. C. A. Westenberg of San Francisco has recently been over the route and was favorably impressed with its possibilities. The rights of way have been secured over the greater portion of the route and work is in a position to be rushed along. The proposed line traverses a rich mining and timber district.

OAKLAND, CAL.—A crosstown line on Peralta street from Seventh to Fortieth streets, and a suburban ferry service, that will connect Fourteenth-street points directly with the Key Route pier through the extension of the Fourteenth-street line westward to the Key Route basin quay wall, are improvements on which the West Oakland Improvement Club are working, with promise of assistance from the Oakland Traction Company and the Key Route system. The extension of the Fourteenth street car line to the new municipal wharf has long been in contemplation, and it is now proposed by the people of West Oakland that the city administration grant the necessary permission to the traction company.

OAKLAND, CAL.—By the first of July trains will be operating between Sacramento and Oakland according to General Manager Napthaly of the Oakland, Antioch & Eastern Railway. Work is being rushed on the new line, and all indications point to the completion of the road by next summer. Contracts for the grading between Sacramento and a point about five miles from Chipp's Island will be completed by next week and the remainder of the grading will be finished by January 15. The ferryboat to be used by the company for transporting passengers across Suisun Bay will be completed by the time the road is ready, and will be used until the bridge is built. Four piledrivers are now at work building the ferry slips on either side of the bay. The contract for the construction of the short stretch of road between Bay Point and Antioch will probably be let this week.

WATERWORKS.

BISHOP, CAL.—The Trustees have awarded the contract for supplying material for the water system to Leece & Waterson.

SUISUN, CAL.—At a special election held here the proposition of issuing bonds in the sum of $20,000 for the improvement of the municipal water system carried.

LOS ANGELES, CAL.—Representatives of the Domestic Water Company from Los Angeles, called on the city trustees recently and presented the proposition of selling its private waterworks to the city for $54,000.

SAN DIEGO, CAL.—The council has set the last Monday in December as the day of sale of the $2,500,000 bond issue which was recently voted to purchase the system of the Southern California Mountain Water Company.

FREEWATER, ORE.—The city council has passed an ordinance providing for the submission to the qualified taxpayers of the city the question of bonding the city in the sum of $12,000 for the purpose of repairing the city water system.

FARMINGTON, WASH.—On opening bids for the sale of the bonds of the town of Farmington to the amount of $10,000 for the construction of a municipal waterworks system, it was found that Carston & Earles of Seattle were the best bidders.

EL CENTRO, CAL.—The First National Bank was the successful bidder for El Centro extension bonds voted last September on its bid of par, $40,000, and accrued interest from September to date of issue. The sale of the bonds means the extension of the water system to portions of the city that await the coming of municipal water.

WINNEMUCCA, NEV.—The big ditch which has been constructed by the Humboldt-Lovelock Irrigation Light & Power Company at Mill City has been thrown open and now is carrying a full load of water. The dam is across the Humboldt River near Mill City and carries the water from the river a distance of about ten miles distributing it to farms in the Lovelock Valley. Natural storage reservoirs near Humboldt house will hold the water in the early spring for use during the summer season. The project will be practical operation next season.